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Book Review

Alan Douglas: "Forensic Seismology and nuclear test bans" Cambridge University Press, 2013; ISBN 978-1-107-03394-8 (hardback), GBP 80.00, USD 130.00

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Forensic seismology is a very good term for describing seismological monitoring performed to distinguish man-made seismic signals from earthquakes. Detection of nuclear explosions is a specific and highly important objective of seismic monitoring, because there is hardly a need to monitor other types of man-made seismic signal. The need for seismological monitoring of nuclear tests was recognized in the early 1950s and eventually led to the establishment of the International Monitoring System and the International Data Center (IDC) of the Comprehensive Test Ban Treaty Organization (CTBTO) in 1996 and to its effective operation in 2000. Over the years, seismological monitoring has been performed by specialized institutions in individual countries. Seismological monitoring was one of the most important stimulants of progress in observational seismology; it led to the process for converting seismology from analogue to digital and to the development of digital seismic data processing.

The author has worked for 35 years at United Kingdom's Atomic Weapons Establishment, AWE, one of the leading institutions performing seismological monitoring, and for 19 years (1982–2001) was head of AWE's Seismology Group. This quite voluminous book of 557 pages is somewhat difficult to classify—it is something between a textbook on forensic seismology and a documentary of AWE's contribution to forensic seismology. As a textbook it contains many examples, including a 42 page album of body wave seismograms from explosions and earthquakes (appendix M). The examples are well explained, so one can study the differences between explosion and earthquake signals on case-by-case basis.

As an AWE documentary the book contains much general seismological information; this is needed to understand the issue but is not AWE's contribution. Nevertheless, the book is brilliant, giving a comprehensive view of seismological monitoring. All issues of forensic seismology are discussed. The discussion is focused on conceptual level rather than on ready solutions, leaving application issues to the initiative of the reader and his mathematical skills. Although many of the concepts are advanced, they are not very complicated, and the number of concepts places the book as a textbook at the graduate or post-graduate level. In fact, the book gives instructions on how to process data at a seismological monitoring data center—one could, in fact, build such center on the basis of the information—if one had the will, the necessary staff and—of course—the funds.

The book is divided into a prologue, 10 chapters, and 13 appendices. The prologue gives historical information, mostly on nuclear test ban politics. Chapter 1, "Seismology: ancient and modern" draws attention to the elements of seismograms that are most important to forensic seismology. Chapters 2–5 are essentially a course of seismology dedicated to forensic seismology. Such issues as travel times and local station effects are thoroughly discussed, as also is the basic processing of digital seismograms, for example filtering, beam forming, and Fourier spectra, up to creation of simple synthetic seismograms. The effects of the seismometer and issues of calibration

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are explained. Chapter 5 covers seismometer array techniques that have proved very effective in forensic seismology, especially for such national institutions as the AWE—as opposed to the IDC, which has the possibility of using a global network of stations. The basics of forensic seismology are covered in Chapters 6–9, which discuss the different methods enabling discrimination of explosions from the variety of other seismic signals. Most of the methods of discrimination rely on observation of P body waves—onset types, seismic source complexity, source mechanisms, and hypocenter locations. However, there are other types of criterion, for example the mb:MS criterion. Much of Chapter 8 is devoted to magnitude issues, which are needed for correct understanding of the magnitude concept, including the way in which the processing magnitudes at the IDC differ from those used at the International Seismological Centre and which often leads to different results in terms of final magnitudes assigned to an event. Chapter 10, "Epilogue", is perhaps somewhat discouraging. The overall message is that after approximately 60 years, seismic monitoring is performed by the IDC but that during the very same period nuclear tests have become very rare. The main purpose of the IDC is production of bulletins, yet the IDC gathers many very valuable seismological data that are seldom used for science because of CTBTO limitations. The title of the last section is "The potential IDC: where do we go from here?". Despite the length of the section, three pages, the question is largely unanswered and leaves the reader with much to think over.

Altogether, the book is a very valuable resource on seismological methods of discrimination for explosions and, specifically, on the techniques used for seismological monitoring, for example those performed at, e.g., the IDC within the scope of the CTBTO.